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मानक

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Mazdoor Kisan Shakti Sangathan

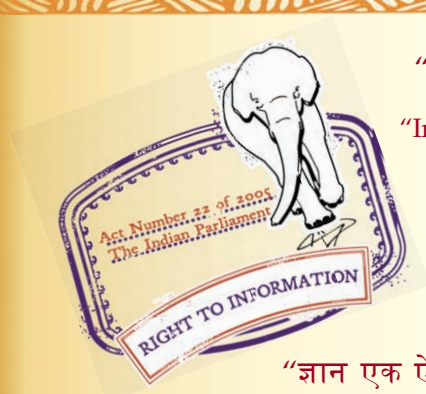
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Jawaharlal Nehru

“Step Out From the Old to the New”

IS 13360-5-11 (1992): Plastics - Methods of Testing, Part 5: Mechanical Properties, Section 11: Determination of Indentation Hardness of Plastics by Means of Durometer (Shore Hardness) [PCD 12: Plastics]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 13360 (Part 5/Sec 11) : 1992

(Reaffirmed 2003)

भारतीय मानक

प्लास्टिक — परीक्षण पद्धतियाँ

भाग 5 यांत्रिक गुणधर्म

अनुभाग 11 ड्यूरोमीटर द्वारा प्लास्टिक की दंतुरण कठोरता ज्ञात करना (शोरकठोरता)

Indian Standard

PLASTICS — METHODS OF TESTING

PART 5 MECHANICAL PROPERTIES

Section 11 Determination of Indentation Hardness of Plastics by Means
of Durometer (Shore Hardness)

UDC 678.5/8 ; 620.178.152.42

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Price Group 2

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Methods of Test for Plastics Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

The indentation hardness is inversely related to the penetration and is dependent of the modulus of elasticity and the viscoelastic properties of the material. The shape of the indenter, the force applied to it and the duration of its application influence the results obtained so that there may be no simple relationship between the results obtained with one type of durometer and those obtained with either another type of durometer or another instrument for measuring hardness.

This method is an empirical test intended primarily for control purposes. No simple relationship exists between indentation hardness determined by this method and any fundamental property of the material tested.

This Indian Standard has been aligned with ISO 868-1985 Plastics and ebonite — Determination of indentation hardness by means of a durometer (Shore hardness) issued by the International Organization for Standardization (ISO).

In reporting the results of a test or analysis made in accordance with this standard, if the final value observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (revised)'.

Indian Standard

PLASTICS — METHODS OF TESTING

PART 5 MECHANICAL PROPERTIES

Section 11 Determination of Indentation Hardness of Plastics by Means of Durometer (Shore Hardness)

1 SCOPE

This Indian Standard describes a method for the determination of the indentation hardness of plastics by means of durometers of two types: durometer Type A used for softer materials and durometer type D for harder materials (*see* Note in 9.2).

The method permits measurement either of the initial indentation or of the indentation after a specified period of time, or both.

NOTE — The durometers specified in this Indian Standard are referred to as Type A shore and Type D shore durometers and the methods are durometer methods.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard.

IS No.	Title
196 : 1966	Atmospheric conditions for testing (<i>revised</i>)
2828 : 1964	Glossary of terms used in plastics industry
13360 (Part 1) : 1992	Methods of testing plastics : Part 1 Introduction

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 2828 : 1964 shall apply.

4 PRINCIPLE

Measurement of the penetration of specified indenter forced into the material under specified conditions.

5 APPARATUS

Shore durometers, types A and D

The durometers consist of the following components:

- a) *Press foot* — Press foot with a hole of diameter between 2.5 and 3.5 mm, centred at least 6 mm from any edge of the foot.

- b) *Indenter* — Indenter formed from a hardened steel rod of diameter between 1.10 and 1.40 mm, to the shape and dimensions shown in Fig. 1, for type A durometers, and Fig. 2 for type D durometers.

- c) *Indicating device* — Indicating device for reading the extent of protrusion of the point of the indenter beyond the face of the pressure foot; this may be read directly in terms of units ranging from 0, for the full protrusion of 2.50 ± 0.04 mm to 100 for nil protrusion obtained by placing the pressure foot and indenter in firm contact with a flat piece of glass.

NOTE — The device may include means for indicating the initial indentation obtained when the indenter is applied under load, to provide a maximum reading for use as an instantaneous reading, if required (*see* 9.1).

- d) *Calibrated spring* — Calibrated spring for applying force to the indenter in accordance with one of the following equations :

- i) $F = 550 + 75 H_A$

where

F is the applied force, in millinewtons;

H_A is the hardness reading on the type A durometer;

- ii) $F = 445 H_D$

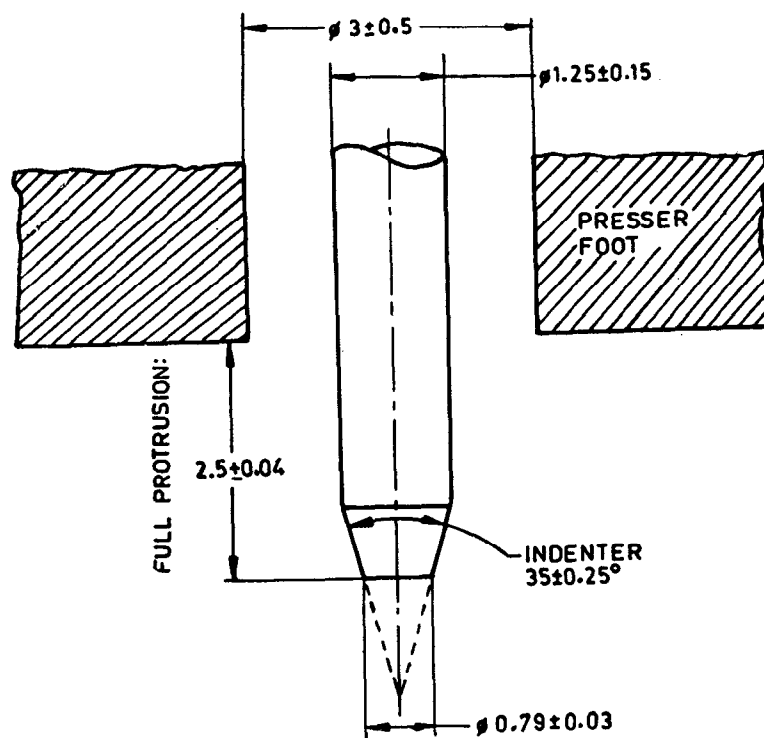
where

F is the applied force, in millinewtons;

H_D is the hardness reading on the type D durometer.

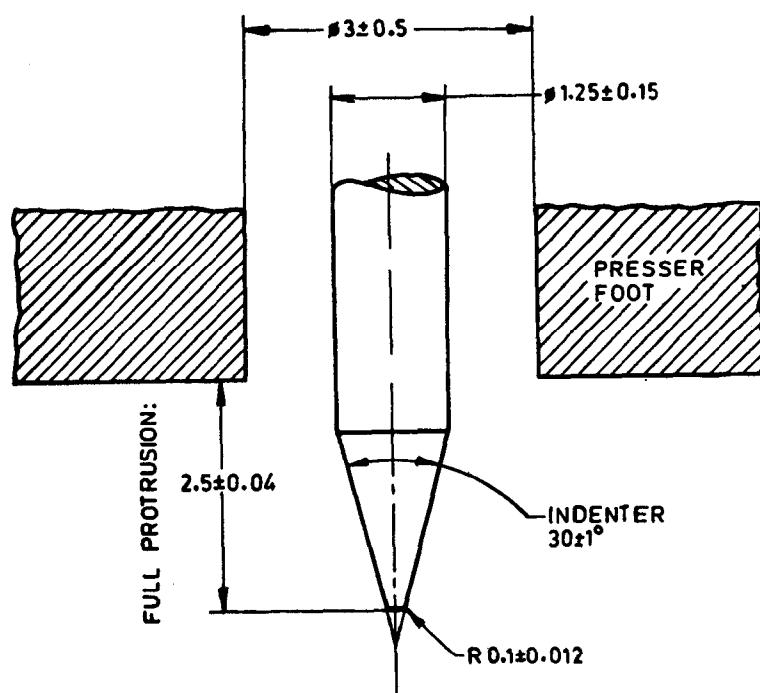
6 TEST SPECIMEN

6.1 The thickness of the test specimen shall be at least 6 mm. A test specimen may be composed of thinner layers to obtain the necessary thickness, but determination made on such test specimens may not agree with those made



All dimensions in millimetres.

FIG. 1 INDENTER FOR TYPE 'A' DUROMETER



All dimensions in millimetres.

FIG. 2 INDENTER FOR TYPE 'D' DUROMETER

on the one-piece test specimens because the surface between plies may not be in complete contact.

6.2 The dimensions of the test specimen shall be sufficient to permit measurements at least 12 mm away from any edge, unless it is known that identical results are obtained when measurements are made at a lesser distance from an edge. The surface of the test specimen shall be flat over an area sufficient to permit the presser foot to be in contact with the test specimen over an area having a radius of at least 6 mm from the indenter point. Satisfactory durometer hardness determinations cannot be made on rounded, uneven or rough surfaces.

7 CALIBRATION

The spring of the durometer (5 d) is calibrated by supporting the durometer in a vertical position and resting the point of the indenter (5 b) on a small metal spacer at the centre of one pan of a balance, as shown in Fig. 3, in order to prevent interference between the presser foot (5 a) and the pan (*see Note*). The spacer has a small cylindrical stem of height approximately 2.5 mm and diameter approximately 1.25 mm, and is slightly cupped on top to accommodate the indenter point. The mass of the spacer is balanced by a weight on the opposite pan of the balance. Weights are added to the opposite pan to balance the force on the indenter at various scale readings. The measured force shall be equal to the force calculated by either equation [5 d (i)] and ± 75 mN or equation [5 d (ii)] within ± 445 mN.

NOTE — Instruments specifically designed for calibration of durometers may be used. Balances or instruments used for calibration should be capable of measuring or applying a force on the point of the indenter within 3.9 mN for the type A durometer, and within 19.6 mN for the type D durometer.

8 CONDITIONING AND TESTING ATMOSPHERES

8.1 For materials whose hardness is not dependent on the relative humidity, the durometer and test specimens shall be conditioned at the temperature of test (*see 8.2*) for at least 1 h before testing. For materials whose hardness is dependent on the relative humidity, the test specimens shall be conditioned in accordance with IS 196 : 1966 and IS 13360 (Part 1) : 1992 or according to the relevant materials specification.

NOTE — When a durometer is moved from a location below room temperature to a location with a higher temperature, it should be placed in a suitable desiccator or airtight container immediately upon removal and allowed to remain there until the temperature of the durometer is above the dew point of the air in the new environment.

8.2 Tests shall be carried out in one of the standard atmospheres specified in IS 196 : 1966 unless otherwise stated in the relevant material specification.

9 PRODEDURE

9.1 Place the test specimen on a hard, horizontal, plane surface. Hold the durometer in a vertical position with the point of the indenter (5 b) at least 12 mm from any edge of the test specimen. Apply the presser foot (5 a) to the test specimen as rapidly as possible, without shock,

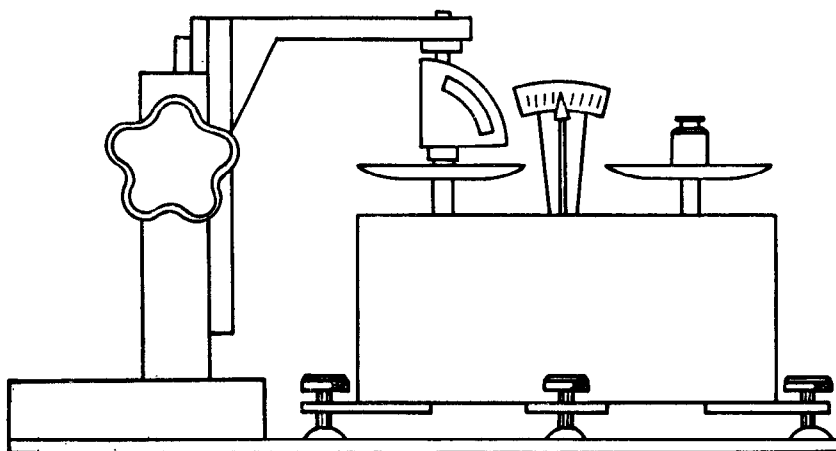


FIG. 3 APPARATUS FOR CALIBRATION OF DUROMETER SPRING

keeping the foot parallel to the surface of the test specimen. Apply just sufficient pressure to obtain firm contact between presser foot and test specimen (see Note).

Read the scale of the indicating device (5 c) after 15 ± 1 s. If an instantaneous reading is specified, read the scale within 1 s after the presser foot is in firm contact with the test specimen, unless the durometer has a maximum indicator, in which case the maximum reading shall be taken.

NOTE — Better reproducibility may be obtained by using either a durometer stand or a weight centred on the axis of the indenter, or both, to apply the presser foot to the test specimen. Recommended masses are 1 kg for the type A durometer and 5 kg for the type D durometer.

9.2 Make five measurements of hardness at different positions on the test specimen at least 6 mm apart and determine the mean value.

NOTE — It is recommended that measurements be made with the type D durometer when values above 90 are obtained with the type A durometer and that measurements be made with the type A durometer when values less than 20 are obtained with the type D durometer.

10 TEST REPORT

The test report shall include the following particulars:

a) reference to this Indian Standard;

- b) complete identification of the material tested;
- c) description of test specimen, including thickness and, in the case of a composite test specimen, the number of layers;
- d) temperature of test, and relative humidity when hardness of the material is dependent on humidity;
- e) type of durometer (A or D);
- f) if possible and required, time elapsed between the preparation of the test specimen and the measurement of hardness;
- g) individual values of indentation hardness and time interval after which each reading was taken;

NOTE — Readings may be reported in the form Shore hardness A/15 : 45, where A is the type of durometer, 15 the time in seconds, between bringing the presser foot in firm contact with the test specimen and taking the reading, and 45 is the reading. Similarly, Shore hardness D/1 : 60 indicates a reading of 60 on the type D durometer obtained either within 1 s or from a maximum indication

- h) average value of indentation hardness; and
- j) details of procedure not specified in this Indian Standard to which reference is made and any incidents likely to have influenced the results.

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